



Newsletter

Volume 5, Number 6
November-December 1988

AT THE ARBORETUM

Mid-January marks the start of the winter series of public education offerings:

Sunday Ecology Programs will bring not only outdoor experiences to draw you closer to nature in winter but also warm weather adventures, through slide presentations.

New Continuing Education Program classes, workshops and ecological excursions have been developed for those of you interested in gardening, landscape design, botany and ecology.

The IES Newsletter is published by the Institute of Ecosystem Studies at the Mary Flagler Cary Arboretum. Located in Millbrook, New York, the Institute is a division of The New York Botanical Garden. All newsletter correspondence should be addressed to the Editor.

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Lyme Disease Bacteria: New Findings, New Questions

Scientific discoveries often answer questions... and perhaps just as often they bring up new ones. Recent findings concerning two new variants of the bacterium responsible for Lyme disease have done just that.

Medical research on Lyme disease began in 1975, when 39 children and 12 adults in Old Lyme, Connecticut fell victim to a mysterious ailment. The cause was found to be a spiral-shaped bacterium called *Borrelia burgdorferi*, transmitted by the bite of a tick, *Ixodes dammini*.

The Lyme tick, as the tiny animal became known, has three stages in its life cycle, and ticks at each stage must find one "blood meal" to survive. The ticks are not too particular about which mammalian host provides that blood, although the white-footed mouse is a common host for larval and nymph stages while adult ticks are often found on white-tailed deer.

The nymph stage of the Lyme tick appears to be most likely to infect humans, although adult ticks cannot be ruled out completely. Lyme disease frequently begins with a red, ring-like rash at the site of the tick bite. Flu-like symptoms and long-term health problems may develop later, but medical reports indicate that the disease is easily cured with antibiotics if diagnosed in its early stages. The geographic range of Lyme disease has expanded quickly since 1975 and cases have now been reported in 35 states.

Ecological research on the Lyme tick began in 1984 at the Institute of Ecosystem Studies. Noting the expanding

range of the tick, and especially the increasing numbers in areas to the south of New York's Dutchess County, IES Wildlife Ecologist Jay McAninch and colleagues started to look for *I. dammini* on deer at the Mary Flagler Cary Arboretum. That year, the ticks were found but none carried *B. burgdorferi*. In 1985, however, ticks carrying the bacterium were found on a white-footed mouse and an opossum, and blood samples taken from deer in 1986 showed the presence of antibodies to the bacterium. These discoveries marked the first time in the ten-year history of Lyme disease that biologists discovered the bacterium in an area before any human cases were recorded, and gave Mr. McAninch and colleagues the opportunity to study the ecology of the tick and its host mammals.

In order to learn more about the various mammalian hosts of the Lyme tick, Mr. McAninch set trap boxes, examined the live animals for the presence of ticks, took blood samples, and then released the animals at the site of capture. When it was of interest to study the ticks themselves, an additional stage was added to the study process: the mammals were transferred to wire cages at the IES field laboratory and the cages placed over water. Engorged ticks dropped off the animals, fell into the water, and were recovered for identification and examination. This work has led to two recent discoveries.

Cottontail rabbits are hosts to *Ixodes dentatus*, a species of tick related to the Lyme tick. *I. dentatus* collected from

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IES Wildlife Ecologist Jay B. McAninch has been studying the ecology of the Lyme tick. He and scientific colleagues recently described two variants of the bacterium known to cause Lyme disease.

Bacteria, from page 1

cottontail rabbits at IES and at The New York Botanical Garden in the Bronx were sent to laboratories specializing in bacteriological studies, and their tissues were examined for the presence of species of *Borrelia* bacteria. Biochemical and genetic tests were done on the bacteria that were found, and it was determined that they were different from the known strains of *B. burgdorferi* but were not a new species. This was the first isolation of borreliae from rabbits and *I. dentatus*.

Many things about the rabbit-tick *Borrelia burgdorferi* are not yet known, however. Is the bacterium capable of causing Lyme disease in humans or other animals? It has been speculated that some of the variations in the symptoms or severity of the disease result from infection by variants of the bacterium. How would the rabbit-tick *B. burgdorferi* infect humans? Although *I. dentatus* feeds almost exclusively on rabbits and birds, *I. dammini* can occasionally be found on rabbits and is frequently found on birds. Thus, *I. dammini* could potentially transmit the rabbit tick borreliae to its other hosts, including humans. Could cases of Lyme disease appear in urban areas, among people without a history of travel in rural areas where Lyme ticks are found? As cottontail rabbits from the Bronx have been found to host borreliae, this possibility cannot be ruled out.

A second discovery involves another variant of *B. burgdorferi*. This time, Lyme ticks from white-footed mice were

collected in the water trays and attempts were made to isolate bacteria from the ticks' tissues. *B. burgdorferi* were found in 4 of the 66 ticks studied, and tests proved them to be identical to each other yet slightly different from the bacterium originally discovered to cause Lyme disease. This new variant so far has been found only in Millbrook, New York. In a paper describing their findings the scientists note the need for additional studies to learn whether it can infect humans or domestic animals and whether it is prevalent in wildlife and Lyme tick populations in upstate New York and elsewhere. In June 1988, collaborating laboratories began screening blood samples taken from human, canine and equine Lyme disease patients in the Millbrook area.

A number of questions has been raised by the recent discoveries by Jay McAninch and his colleagues regarding the bacterium/tick/mammal complex, a complex that in some combinations can lead to the onset of Lyme disease. In the process of discovering the answers to these questions, more new questions will arise. This on-going process will result in the development of an important body of knowledge about the ecology and epidemiology of Lyme disease.

Reports detailing the research described in this article appear in the JOURNAL OF CLINICAL MICROBIOLOGY (the October 1988 and January 1989 issues).

Jay McAninch did his master's degree research at the Arboretum in 1974-75 and was appointed wildlife biologist in September 1976. His research, in addition to the Lyme disease work, has included population ecology and management of deer; hunting, fencing and repellents as population control measures; population ecology and management of voles; and habitat management for wild mammal control in agricultural areas.

Mr. McAninch recently accepted a position as senior research specialist with the Minnesota Department of Natural Resources at the Madelia Research Station. His research will deal with population dynamics, ecology and management of deer in Minnesota; his goal is to design innovative solutions to deer management problems and to advance knowledge of the ecology of deer in that state. He and his family will live in New Ulm, Minnesota.

Tribute Garden Grant

The Millbrook Tribute Garden, Inc. has awarded the Institute a grant in support of the Outdoor Science Discovery Center. This center, being developed by the IES Public Education Program, will consist of a series of large-scale outdoor exhibits inspired by actual ecological research projects.

During summer 1988 two of these exhibits were open to the public, showing the effects of environmental pollution as well as the way in which scientists study ecosystems affected by pollution. The air pollution garden, with paired plantings of ozone-sensitive and ozone-tolerant plants, graphically demonstrated what happens to plants when ozone levels are high. Adjacent to the garden were the acid rain study ponds, where Arboretum visitors could observe the effects of increased acidity on miniature pond ecosystems. During September and October, 550 students from local elementary and high schools took clipboards in hand and



became "scientists for a day", helping collect acid rain data at these ponds.

IES research displays coordinator Laury Zicari reports that both these exhibits will be expanded during the next 12 months, and that a third exhibit -- a "human disturbance trail" to demonstrate examples of how human use has affected the forest ecosystem -- will complete the current phase of the Outdoor Science Discovery Center.

Left: Monica Volkmann, project assistant (holding fish trap), helped 550 elementary and high school students become acid rain detectives. Here young scientists are looking for animals and plants in one of the acid rain study ponds.

The Hudson River Ecosystem: Meeting at IES

The Hudson River flows 507 kilometers (315 miles) from Lake Tear of the Clouds in the Adirondack Mountains south to New York City. The Hudson as we know it today has existed for a relatively short period of time in geological terms -- approximately 12,000 years -- but external and internal forces have affected it greatly, especially throughout the more recent part of this period. Because of the river's great historical, cultural and economic importance, there is much interest in learning more about it, and research on the Hudson River ecosystem is now being done by a number of organizations.

Institute of Ecosystem Studies scientists are among those involved in this research, and on October 11th and 12th IES hosted a meeting on "Basic Ecosystem Processes in the Hudson Estuary". The meeting, coordinated by IES aquatic ecologist Dr. Stuart Findlay, brought together scientists involved in research on the Hudson River, administrators of the Hudson River Foundation, representatives of the New York State Department of Environmental Conservation (DEC), and representatives of several environmental groups.

During the first day of the meeting, each participating scientist presented a short summary of his or her research. Topics of the twelve talks included primary production (the storing of the sun's energy as food, accomplished by photosynthesis in simple green plants such as algae); bacterial production; zooplankton abundance and dynamics; nutrient cycling

and oxygen metabolism; location and movement of the river's freshwater/saltwater boundary; and the role of science in environmental management.

On the second day of the meeting, a three-member panel -- Dr. Gene E. Likens, director of the Institute of Ecosystem Studies; Dr. Robert W. Howarth, associate professor in the Section of Ecology and Systematics at Cornell University; and Dr. Dennis Suszkowski, science director of the Hudson River Foundation -- presented an overview and synthesis of the scientific reports.

Stressed was the importance of close work between scientists and managers, increasing their understanding of each other's jargon and each other's needs. Many of the current management problems -- such as sewage, PCBs (polychlorinated biphenyls, types of chlorinated hydrocarbons that are used in industry and are persistent pollutants, especially in aquatic ecosystems) and fisheries -- are also of interest to ecologists and will be solved best with input from the scientific community. Another recommendation by the panel was funding of long-term studies to make sure that climatic cycles and extremes are considered in the measurement period. Credit was given to the Hudson River Foundation for funding basic research on the river.

A general discussion concluded the meeting. Of the many suggestions for

future Hudson River work, three drew the most attention. First, it was proposed that all existing publications and reports on the Hudson River ecosystem be compiled in one work; in cases where data on the Hudson were lacking, publications on similar river systems would be included. Second, it was suggested that the Hudson River Foundation actively encourage scientists studying the river to compare their results with those from the study of similar ecosystems, in response to the need to know how this system behaves in comparison to others. Finally, the use of a "red-yellow-green light system" was considered for projects with potential environmental impact on the river's ecosystem. This system, recently adopted by the U.S. Forest Service in its management strategy for wilderness areas, provides that a project could be stopped completely after review of scientific data... the red light. Projects that could proceed without additional review would get the green light, while those requiring further information would get the yellow light.

The participants hope that this meeting, and others that will follow, will result in the development and implementation of the best approaches to the understanding, management and preservation of the Hudson River ecosystem. Meetings such as this are very helpful in integrating complex scientific information obtained by workers at different institutions.

Staff

WENDY DEMBO, greenhouse gardener, assists David Bulkeley in the care of the extensive tropical and research plant collections. Her responsibilities also include helping with scientific research in progress at the greenhouse.



GLYN CLOYD

LARRY DEROSIA, research assistant I, works for Donald Buso, manager of field research at the Hubbard Brook Ecosystem Study in New Hampshire. His duties include collecting and measuring pH of water samples. He has a bachelor's degree in biology from Plymouth State College in New Hampshire.

ELIZABETH FUNKE, research assistant I, works for aquatic ecologist Dr. Michael Pace. From late-May through mid-September she collects and processes water samples from lakes in northern

Wisconsin. During the rest of the year she is at IES, analyzing the bacteria and zooplankton samples she collected. She has a dual bachelor's degree in natural resources management and forest and environmental biology from the SUNY College of Environmental Science and Forestry at Syracuse.



GLYN CLOYD

JUDY SULLIVAN, gardener, was formerly the manager of a landscaping nursery. At IES she works for Bradley Roeller, manager of display gardens, and is --in her words--responsible for the health, welfare and aesthetic appeal of display plantings throughout the Arboretum.



GLYN CLOYD

Promotion

TOM BUTLER, working with Dr. Gene E. Likens for twelve years, has been promoted to research assistant III. Mr. Butler is collecting data for three atmospheric monitoring networks by sampling precipitation and air at a rural site near Ithaca, New York. MAP3S (Multistate Atmospheric Power Production Pollution Study), with 9 sampling sites in the eastern United States, is monitoring rainfall chemistry. The Fine Particle and Visibility Monitoring Program, also an eastern U.S. network, is assessing trends in atmospheric visibility. Finally, spanning the country, the National Dry Deposition Network collects information on chemical particles in the air as well as on ozone levels and meteorological conditions. The data that Mr. Butler collect are regionally representative, and help scientists understand long-term trends in atmospheric quality.

IES Graduate Student Honored

Khadga Basnet, a graduate student at IES and Rutgers University, has recently been appointed an Associate Member of the International Centre for Theoretical Physics (ICTP) in Trieste, Italy. In the twenty-four years of its existence, the ICTP has earned an international reputation for promoting scientific growth in developing countries.

Mr. Basnet, from Nepal, is studying factors that influence landslides on steep slopes in the tropical rainforests of Puerto Rico. His doctoral thesis advisor is IES Director Dr. Gene E. Likens.

Local Weather

Data collected at the IES Weather Station provide background information for ecological research at the Institute and serve as a standard against which long-term trends in weather and air quality may be compared.

September and October, 1988

Highest temperature: 27.5°C (81.5°F) on September 19th

Lowest temperature: -8.8°C (16.2°F) on October 31st

Daily average temperature: 11.5°C (52.7°F)
[Normal*: 13.2°C (55.8°F)]

Precipitation: 9.45 cm (3.7 in.)
[Normal: 17.96 cm (7.1 in.)]

Average rainfall pH*: 4.34

Strongest wind gust: 57 km/hr (35.6 m.p.h.) from the southwest (220°) on October 10th

Prevailing wind direction: South (173°)

Average wind speed: 7km/hr (4.3 m.p.h.)

**"Normal" values are taken from data collected for a 30-year period at the Millbrook School.*

***Degrees of acidity or alkalinity are indicated using a logarithmic pH scale. On the scale of 0-14, vinegar (an acid) has a pH of approximately 3, and "neutral" is 7.0. The pH of "normal" rain is 5.6 or higher.*

Winter Calendar

CONTINUING EDUCATION PROGRAM

Catalogues describing IES courses, workshops and ecological excursions scheduled for the winter and spring terms are available at the Gifford House. Offerings for the winter semester (January, February and March) are:

Landscape Design, Gardening and Botany Courses

Graphics
Landscape Design II. Plan Development
Landscape Design III. Planting Design
Cost Estimating for Landscape Projects
Floriculture
Annuals and Perennials for Landscaping
The Hows of Houseplants
Growing Herbs Indoors
Intensive Organic Gardening
An Introduction to Growing Annuals
Gardening for Winter Interest

Workshops

Jan. 21 Landscaping with Perennials in the Mixed Border
Feb. 18 Homeowner's Guide to Lawn Maintenance
Mar. 11 Planting the Seeds for Your New Business
Mar. 18 Wetlands: Ecology and Restoration

Ecological Excursions

Jan. 28 A Lake in Winter: Frozen Ecology
Mar. 9 The New York Flower Show

SUNDAY ECOLOGY PROGRAMS

Free public programs are offered on the first and third Sunday of each month, except over holiday weekends. All programs are from one to two hours long, and begin at 2:00 p.m. at the Gifford House on Route 44A unless otherwise noted.

Tentative schedule (please call (914) 677-5358 to confirm the day's topic):

Jan. 15 Which Came First: The Flower or the Pollen? (Dr. Steward T.A. Pickett) -- Talk
Feb. 5 Coral Reefs of the Bay Islands of Honduras (Dr. Nina M. Caraco) -- Talk
Feb. 19 Identifying Woody Plants in Winter (Kass Hogan) -- Walk
Mar. 5 Marshes to Mangroves ... Boothbay to

Bimini (Dr. Thomas S. Bianchi) -- Talk
Mar. 19 The Ecology of the Sugar Maple -- Walk

For ecology walks, dress according to the weather with sturdy, waterproof footwear. Talks are slide presentations held indoors. In case of inclement weather, call (914) 677-5358 after 1 p.m. to learn the status of the day's program.

GREENHOUSE

The IES Greenhouse is a year-round tropical-plant paradise as well as a site for controlled environmental research. The public is invited to explore both aspects during Arboretum hours. There is no admission fee, but visitors should first stop at the Gifford House for a free permit.

GIFT SHOP

Pre-Inventory Sale: 50% off remaining holiday items; 10% off books; 20% off all other goods. Sale lasts through January. See below for hours.

ARBORETUM HOURS (Oct. 1-Apr. 30):

The Arboretum is open Monday through Saturday, 9 a.m. to 4 p.m.; Sunday 1-4 p.m. The Gift and Plant Shop is open Tuesday through Saturday 11 a.m. to 4 p.m. and Sunday 1-4 p.m. (closed weekdays from 1-1:30 p.m.).

The Arboretum and Shop are closed on public holidays. Roadways and trails are closed when snow-covered.

All visitors must obtain a free permit at the Gifford House for access to the Arboretum. Permits are available up to one hour before closing time.

MEMBERSHIP

Join the Mary Flagler Cary Arboretum. Benefits include a special member's rate for IES courses and excursions, a 10% discount on purchases from the Gift Shop, free subscriptions to the IES Newsletter and *Garden* (the beautifully illustrated magazine for the enterprising and inquisitive gardener), and parking privileges and free admission to the Enid A. Haupt Conservatory at The New York Botanical Garden in the Bronx. Individual membership is \$25; family membership is \$35. For more information on memberships, contact Janice Claiborne at (914) 677-5343.

For more information, call (914) 677-5358 weekdays from 8:30 - 4:30

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Permit No. 16



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